

MAGNETICALLY OPERATED HINGE SWITCH

Field of the Invention

[0001] The present invention relates to switches used to detect the closing of a door or lid where two parts of the switch connected by a hinge are moved towards each other.

Background of the Invention

[0002] In many applications it is desirable to be able to positively detect that a certain action has taken place, for example that the hood of a car has been properly closed. Prior art devices are usually comprised of a base that contains a sensor and an arm that is mounted by a hinge to the base that contains a means for interacting with the sensor. These prior art devices typically require three or more separate parts and a metal biasing means for keeping the sensor open. The metal biasing means can often be exposed to corrosion depending on the environment of the use. What is needed is a hinge type switch of simpler and more robust construction.

Summary of the Invention

[0003] The hinge switch of this invention has a unitary plastic body that can be formed by injection moulding or extrusion. The unitary plastic body has a base that can be fastened to a support structure by a plurality of fasteners that pass through the base and through the support structure. The base is connected to an arm by an elastic U-shaped portion of the plastic body that acts as both a hinge and a biasing member. The U-shaped portion is substantially thinner and thus more flexible than the base or the arm. The base has an end face into which is formed a sensor-receiving cavity. Positioned within the cavity is a sensor module that is connected by wire leads to a connector plug. The sensor module contains a magnetic field

sensor such as a reed switch or Hall effect sensor. The arm is less wide than the base so that it does not block access to the plurality of fasteners that mount to the base to the support structure. The arm has portions defining an opening into which an activation magnet is placed.

[0004] It is a feature of the present invention to provide a switch of unitary construction.

[0005] It is a further feature of the present invention to provide a hinge switch wherein the material of the hinge elastically biases the switch to an open position.

[0006] It is another feature of the present invention to provide a hinge switch that is not subject to corrosion.

[0007] Further features and advantages of the invention will be apparent from the following detailed description when taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0008] FIG. 1 is an exploded isometric view of the lever arm sensor of this invention.

[0009] FIG. 2 is a side elevational view partially cut away in section, of the lever arm sensor of FIG. 1.

Detailed Description of the Invention

[0010] Referring more particularly to FIGS. 1–2 wherein like numbers refer to similar parts, a lever arm switch 20 is shown in FIGS. 1 and 2. The lever arm switch 20 has a plastic body 21 which includes a base 22, a hinge 24,

and a closure arm 26 which are integrally formed of plastic, for example polypropylene, as a single injection moulded piece. The hinge 24 takes on a smooth U-shaped form 28 as illustrated in FIG. 2 when the closure arm 26 is brought into engagement with a stop 30 which is integral with the base 22 and the entire switch 20.

[0011] The base 22 has two mounting holes 32 into which fasteners 34 are positioned to hold the base 22 fixed with respect to a mounting structure 36 by passing through the holes 32 in the base and into corresponding holes 37 in the mounting structure. The base 22 has a thick section 38 that is joined by a smooth transitional section 40 to the hinge 24. The mounting holes 32 pass vertically downwardly through the thick section 38 of the base. The base 22 has an overall rectangular shape with an end face 42 opposite the hinge 24 into which is formed a sensor cavity 44. The stop 30 is positioned above the sensor cavity 44. A sensor module 46 is positioned within the sensor cavity 44. The sensor module 46 contains a magnetic field sensor 48 which may be a reed switch, a Hall effect sensor, a GMR sensor, an induction coil or other means of detecting an electromagnetic field. The sensor is connected to a two or more wire leads 49 that terminate in a connector plug 52.

[0012] The closure arm 26 is connected to an upper transition section 50 but does not extend along the entire transition section 50 so that the arm 26 does not overlie the mounting holes 32 in the base 22 allowing access to install or remove the fasteners 34. Thus the arm 26 and the transition section 50 define a rectangular open space 54 which allows vertical access to the mounting fasteners 34. The closure arm 26 has portions defining a cavity 56 into which in activation magnet 58 is bonded or insertion moulded. The magnet 58 is positioned so as to activate, or be detected by the magnetic field sensor 48 within the sensor module 46 positioned within the sensor cavity 44 within the base 22. The stop 30 limits the motion of the closure arm 26, as shown in FIG. 2 and positions the activation magnet 58 to be detected by the

magnetic field sensor 48 within the sensor module 46 which is mounted in the sensor cavity 44.

[0013] The closure arm 26 and the base 22 are about the same thickness, and are connected by the lower transition section 40 and the upper transition section 50 to the hinge 24 which has about one-half the thickness of the closure arm 26 and the base 22. The greater thickness of the base 22 and the closure arm 26 means that substantially all elastic deformation caused by the motion of the closure arm downwardly, as indicated by arrow 60, occurs in the hinge 24. The smooth transition sections 40, 50 provide a gradual transition between the flexible hinge 24 and the substantially rigid base 22 and closure arm 26. The gradual transition prevents stress concentrations caused by the change in section between the base 22 and the arm 26 and the hinge 24. The minimization of stress concentrations results in a relatively low stressed hinge 24 with a flexure of about 30 degrees or less and the use of a suitable plastic such as polypropylene will produce a switch with a desirable long life.

[0014] It should be understood that while the hinge switch 20 is preferably formed as a single injection moulded part it could be cut from a continuous extrusion. It should also be understood that the activation magnet 58 and the sensor module 46 could be mounted to the hinge switch 20 by moulding-in-place, bonding, or by being potted, heat staked or fastened to the switch body 21. It should also be understood that if a reed switch is used as the magnetic field sensor, it could be of the type that is normally open, or the type which is normally closed. Without thickness discontinuity, should be understood to mean a gradual, smooth transition to avoid producing a stress concentration.

[0015] While the invention has been explained with reference to the specific embodiments of the invention, the explanation is illustrative and the invention is limited only to the appended claims.